Homework

Pure Virtual Functions and Inheritance

Objective:
The objective of this assignment is to understand and implement pure virtual functions and inheritance in C++. You will create a three-level hierarchy of classes representing different types of vehicles, demonstrating the use of pure virtual functions and polymorphism.

Instructions:

1. **Create an Abstract Base Class: Vehicle**

This class should have protected data members: **speed** and **fuel**.
It should contain a pure virtual function **displayInfo()** to display vehicle information.
The class should also have a constructor to initialize the **speed** and **fuel** data members.
Provide setter and getter functions for the data members.

2. **Create a Derived Class: LandVehicle**

This class should inherit from **Vehicle**.
It should add a new data member **numWheels**.
Override the **displayInfo()** function to display information specific to land vehicles.
Provide a constructor to initialize **speed**, **fuel**, and **numWheels**.

3. **Create a Derived Class: WaterVehicle**

This class should inherit from **Vehicle**.
It should add a new data member **numEngines**.
Override the **displayInfo()** function to display information specific to water vehicles.
Provide a constructor to initialize **speed**, **fuel**, and **numEngines**.

4. **Create a Derived Class: AirVehicle**

This class should inherit from **Vehicle**.
It should add a new data member **numWings**.
Override the **displayInfo()** function to display information specific to air vehicles.

Provide a constructor to initialize **speed**, **fuel**, and **numWings**.

5. Create Another Derived Class: Car

This class should inherit from **LandVehicle**.
It should add a new data member **numDoors**.
Override the **displayInfo()** function to display information specific to cars.
Provide a constructor to initialize **speed**, **fuel**, **numWheels**, and **numDoors**.

6. Create Another Derived Class: Boat

This class should inherit from **WaterVehicle**.
It should add a new data member **numSails**.
Override the **displayInfo()** function to display information specific to boats.
Provide a constructor to initialize **speed**, **fuel**, **numEngines**, and **numSails**.

7. Create Another Derived Class: Plane

This class should inherit from **AirVehicle**.
It should add a new data member **numEngines**.
Override the **displayInfo()** function to display information specific to planes.
Provide a constructor to initialize **speed**, **fuel**, **numWings**, and **numEngines**.

8. Create a Main Function

(1) Coding and running
- In the main() function, create objects of the **LandVehicle**, **WaterVehicle**, **AirVehicle**, **Car**, **Boat**, and **Plane** classes.
- Use pointers of type **Vehicle*** to refer to these objects.
- Demonstrate polymorphism by calling the **displayInfo()** function through the base class pointers.

(2) Create a diagram to illustrate the inheritance hierarchy for the classes in this assignment.